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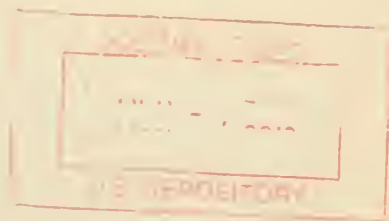
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THE FOWL TICK.

BY

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BUREAU OF ENTOMOLOGY.

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THE FOWL TICK,¹*(Argas miniatus Koch.)*

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INTRODUCTION.

Among the many problems which confront the poultry raiser in the southwestern portion of the United States none surpasses in importance that of the fowl or chicken tick (*Argas miniatus* Koch). The statement has been made by reliable authorities that chicken raising in certain localities in southwestern Texas is practically prohibited by this pest. It is very common to meet people in many sections of the infested area who have disposed of their poultry mainly on account of the losses caused by this tick. The damage occasioned to the man who is raising poultry on a considerable scale is very small when compared with the losses sustained by the hundreds of individuals in town and country who keep a few fowls for home use. This is partly due to the lack of attention given to their poultry by those who do not attempt to go into the industry commercially.

It is difficult to make a reliable estimate of the damage chargeable to the fowl tick, as much of the loss is indirect or complicated with damages produced by other causes. There is no doubt, however, that the total loss due to the pest amounts to many thousands of dollars annually.

HISTORICAL.

A tick which many authorities consider identical with our American form was briefly described by Oken in 1818 from specimens collected in Persia. In 1844 a German investigator, Koch, described specimens from Demerara, British Guiana. The latter were unquestionably of the same species as the tick which occurs in the United

¹ Submitted by permission as a minor thesis for the degree of Master of Science at the Colorado Agricultural College.

States. Our earliest record of the occurrence of the fowl tick in this country was published in 1872 by Dr. A. S. Packard. This was based upon a collection of ticks made by Mr. G. W. Belfrage in southwestern Texas. Dr. L. O. Howard¹ states that Mr. F. G. Schanpp sent specimens of this tick to the Bureau of Entomology in November, 1884. At that time it was said to be a severe pest to chickens in Dimmit County, Tex. Mr. Albert Turpe stated that the tick appeared in Kinney County, Tex., in 1892, but Mr. Ferdinand Hoehr averred that it had been present in that county since 1888. According to a statement of Prof. C. M. Weed published in the *Prairie Farmer*, January 7, 1888, Mr. George H. Trook sent in specimens of this tick from Maricopa County, Ariz., with the information that they were troubling chickens in that section. During December, 1894, Mr. C. H. T. Townsend found the pest infesting chickens at San Diego, Tex., and earlier in the same year Mr. E. M. Ehrhorn reported it as attacking chickens and turkeys at Merced, Cal.

It has not been possible to secure reliable data on the early history of the pest from residents in the infested territory. It seems probable that it has existed in southwestern Texas for many years and was probably introduced from Mexico at the time of the colonization of the State by the Spanish who came in from that country. Furthermore, it has not been firmly established whether the species has been spreading northward in Texas, although the belief that a gradual spread has taken place has been expressed by Prof. E. D. Sanderson. It is certain, however, that the tick is becoming more generally disseminated throughout the infested territory along with the settling up of the Southwest.

DISTRIBUTION.

The chicken tick, "blue bug," "bloodsucker," or "tampan," as it is called in different localities or regions, is a widely disseminated species. In the United States it is infrequently met with outside of the semiarid and arid Southwest. However, it has been reported a number of times from Florida, and the Marx collection in the United States National Museum contains specimens from Iowa. The collection of the Bureau of Entomology contains specimens from a correspondent at Fort Lauderdale, Fla., where the tick was said to be injurious, and Mr. G. A. Runner found the species in numbers at Key West, Fla. In this country, as has been indicated, this tick occurs in greatest abundance in the warm portions of the arid and semiarid region. A careful study of its normal distribution in Texas shows that it does not extend far eastward into the region where the annual rainfall exceeds 30 inches. This makes the eastern edge of its

¹ *Insect Life*, Div. Ent., U. S. Dept. Agr., vol. 7, p. 418, 1895.

range coincide closely with a line dividing one of our life zones, known as the Lower Austral, into the Lower Sonoran and Austroriparian Faunas.

The map (fig. 1) shows approximately the normal distribution of the species in the United States. It is a serious pest throughout the greater part of western Texas, southern New Mexico and Arizona, southern and western California, and on the great plateau of north-central Mexico and in other parts of that country. In many other regions of the world this tick is of importance as an enemy of poultry. It appears to occur commonly in Persia, India, southern Russia,



FIG. 1.—Distribution of the fowl tick (*Argas miniatus*) in the United States. (The large dots indicate localities where this tick has been collected by the Bureau of Entomology. The small dots show the normal distribution of the species within the United States.) (Original.)

Romania, North and South Africa, various parts of Australia, the West Indies, Mexico, Panama, British Guiana, and Brazil.

There appears to be no reason why the species may not become established in all of our Gulf States, as it occurs in other countries which have very similar climates. However, it will probably never become a pest of continuous importance in the States east of Texas on account of their humid climates. There is little danger of the establishment of the species in the more northern States, and the cases where it is occasionally found outside of the area of normal occurrence must be considered as temporary infestations brought

about by the introduction of the tick on fowls or in coops from infested regions. If favorable conditions exist at the time of introduction the tick may breed and become of some importance as a pest for a short period, but sooner or later it is so checked as to be of little consequence or it dies out completely.

HOSTS.

Although the chicken is the host most frequently attacked by this species, a considerable number of other domestic fowls may be troubled by it, and turkeys, geese, ducks, pigeons, ostriches, and canaries have each been found to suffer from its attack. During this investigation a few larvæ of this species have been found in southern Texas on the meadowlark (J. D. Mitchell) and on wild turkey (F. C. Pratt). It has also been reported to have been collected, in rare instances, on cattle and jack rabbits, and experimentally it has been induced to feed upon rats and mice. In Persia this tick, which is known as the "miana bug," has a formidable reputation. It is said to attack man with avidity in that country, and early writers report very serious effects produced by its bite. In some cases it was accused of producing death within 20 hours. These statements are no doubt overdrawn and other species of a closely allied genus (*Ornithodoros*) may have been confused with this one. Prof. Lounsbury, in South Africa, allowed specimens to feed upon his arm and experienced no serious results. In this country we have had no authentic reports of this pest attacking man.

HOW THE INJURY IS DONE.

As a result of the presence of this creature loss is sustained in several ways: (1) Through death, which may occur among poultry of all ages; (2) by the lowering of the vitality of the fowl so as to make it readily susceptible to disease; (3) by greatly reducing egg production; (4) by stunting the growth of chickens; and (5) by disturbing setting hens.

Death may be produced in two ways. First, by gross infestation, which drains the fowl of blood and produces intense irritation similar to "tick worry," caused by the cattle tick and other species among the larger domestic animals. This difficulty is most apparent when chickens are placed in coops which have not been occupied for several months. The ticks are extremely hungry, attack the fowls in great numbers, and soon weaken them to such an extent that they are unable to get on the roost. When the chickens are thus weakened they more readily fall victims to the ticks. In some cases the infested fowls appear paralyzed, being unable to use the legs. The wings droop, the feathers have a ruffled appearance, the appetite is lost, and the fowl may die as soon as two or three days after the first attack.

In less severe infestations, when the fowls are very hearty, they may droop for some time, or, if removed from further infestation, quickly recover.

Second, death may be produced by a specific disease which has been proven to be carried by the chicken tick. This malady, which is known as spirochetosis, has been proven to exist in many countries where the chicken tick occurs, namely, in India, Egyptian Sudan, Transcaucasia, Roumania, Tunis, Algeria, Rhodesia, South Australia, Brazil, and Martinique. It is also probable that the disease occurs in other islands of the West Indies. A disease with many of the symptoms of spirochetosis occurs among chickens in the southwestern part of the United States and in Mexico. The fowl tick has been found associated with this disease. These points strongly indicate that the malady in question is the tick-transmitted spirochetosis known in other countries, although this remains to be definitely proved.

It is readily seen how the weakening effect of the blood loss produced by this species may encourage the development of various diseases. It has been shown by certain authorities that, in feeding, this tick introduces a substance called anticoagulin into the wound produced by the insertion of the mouth parts. This substance and possibly other secretions seem to produce acute inflammation at the point of attack, and when the infestation is heavy the inflammation as well as the loss of blood is an important factor in reducing egg production.

The continued drain upon the systems of chickens from the time they are hatched until full grown is sufficient to account for the reduction in the size of poultry raised in tick-infested houses.

The irritation produced upon setting hens by the attack of the tick in its different stages frequently interferes with successful hatching, in some instances even causing the hens to desert their nests.

LIFE HISTORY AND HABITS.

The habits of the fowl tick are very similar to those of the bed-bug (*Cimex lectularius* L.). It is almost exclusively a night feeder. Because of this habit of engorging on fowls during the night and hiding in the daytime many people do not suspect the presence of the tick until serious loss has been sustained.

The life history of this species is considerably different from that of the ticks ordinarily observed on the farm. The eggs are small, oval, brownish objects, and are deposited in the cracks and crevices about the roosting places of the fowls. During warm weather they hatch in from 10 to 15 days. In the winter the hatching period may exceed three months. The minute six-legged seed ticks or larvae which emerge from the eggs are very different in appearance from

the full-grown ticks. A tick in this stage, as seen from beneath, is shown in figure 2. The seed ticks are light gray in color and the mouth parts can be seen projecting in front of the body. Following hatching they remain quiet on the eggs for a few days and then,

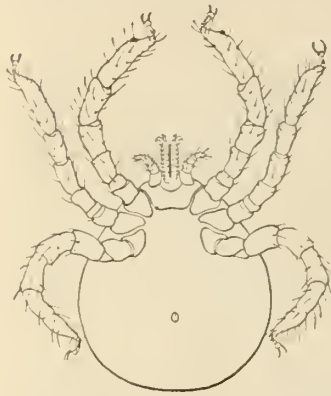


FIG. 2.—A seed tick, the larva of the fowl tick, as seen from beneath. Greatly enlarged. (Original.)

after nightfall, begin actively running about in search of a host. When a suitable host is found they bury the rather long beak in the skin and begin sucking blood. Their favorite places of attachment are on the breast and thighs and under the wings, but they may be found on nearly all parts of the fowl. After feeding has begun they soon become dark blue in color and the body gradually becomes distended and rounded. The fully engorged seed ticks are about one-tenth of an inch in length and are usually of a dark-blue or purplish color. When fully engorged the seed ticks drop from the host. These ticks have acquired the habit of dropping from the

host during the night. It is thus possible for them to find hiding places in the immediate vicinity of the chicken roost. The time required for the seed ticks to engorge has been found to range from $3\frac{1}{2}$ to 10 days.

In from 4 to 9 days after dropping from the host the engorged seed ticks molt their skins and acquire a fourth pair of legs. In cool weather this transformation sometimes requires slightly over a month. In this stage the ticks are known as nymphs (fig. 3). They are slightly larger than the engorged seed ticks but are very much flatter. In this and all subsequent stages the ticks feed almost exclusively at night and do not require

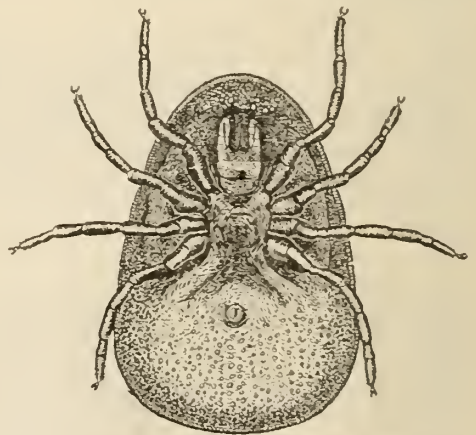


FIG. 3.—Nymph of the fowl tick, as seen from below. Greatly enlarged. (Original.)

more than from a few minutes to an hour to become filled with blood. This enables them to partake of their meal and thoroughly secrete themselves in the cracks during the night and thus escape destruction by the host. Before becoming mature the nymphs feed and molt

their skins twice and sometimes three times. During these successive engorgements and moltings the ticks increase considerably in size but maintain the oval, flattened form.

At the last molt the sexual organs are developed. The males (fig. 4) are slightly smaller than the females (fig. 5), the former measuring about one-fifth of an inch and the latter about one-fourth of an inch in length. Before feeding the adults are of a yellowish-brown color and are very thin. After partaking of blood they change to dark blue and the size increases considerably. The bodies of the males do not distend as much as those of the females. In the adult stages, as also in the nymphal stages, the mouth parts are located on the underside of the front end of the body. They are not usually visible from above. The body is quite leathery and exhibits a cellular appearance with radiating rows of rather smooth, irregular disks. Mating takes place immediately after en-

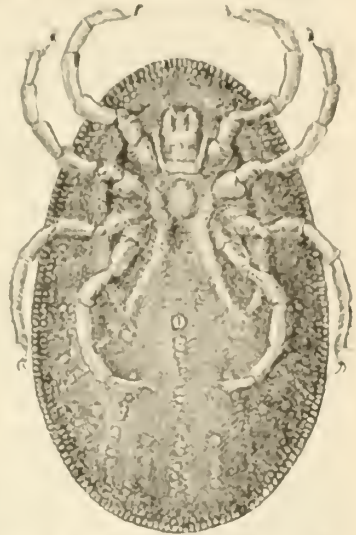


FIG. 4.—Male fowl tick, as seen from beneath. (Note the presence of the genital opening immediately behind the mouthparts.) Greatly enlarged. (Original.)

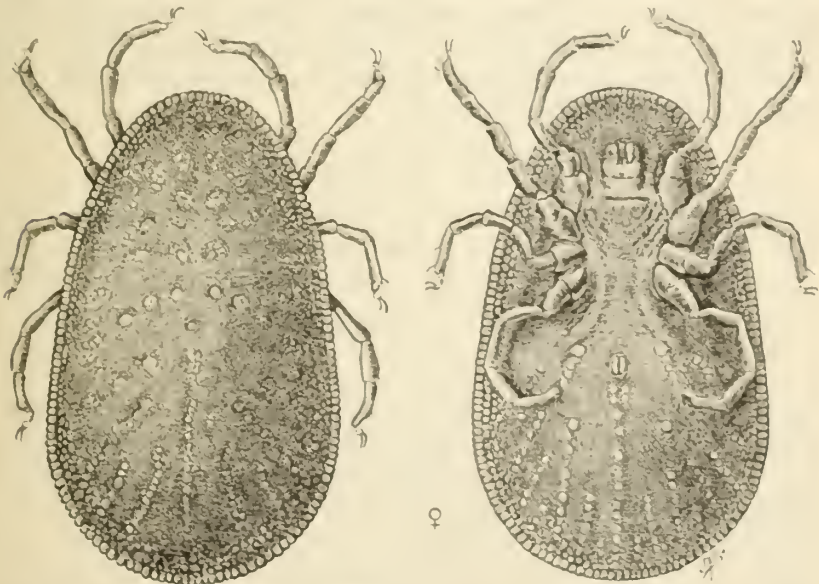


FIG. 5.—Female of the fowl tick, as seen from above and beneath. (Note the transverse genital opening just behind the mouthparts.) Greatly enlarged. (Original.)

gorgement, and the females begin to deposit eggs in from 4 to 10 days later. Often during the winter the females do not deposit for long

periods and sometimes require a second engorgement before egg laying begins.

Unlike many species of ticks, the female does not die upon completion of the first deposition, but again fills with blood and produces another batch of eggs. This process of feeding followed by deposition may take place as many as seven times, the average number being about three or four. The largest number of eggs which we have observed to be deposited by a single female is 874 and the average number 537. It will thus be seen that although deposition takes place a number of times, the total number of eggs produced is considerably smaller than the number deposited by many of our common species of ticks. For example, the average number of eggs deposited by the cattle tick is between 3,000 and 4,000. As has been stated, the eggs are to be found in small clusters associated with all stages of the tick in the cracks and crevices about the chicken house.

One of the most remarkable features of the life history of this creature is its great length of life without food. The seed ticks have been found to live for a period of $5\frac{1}{2}$ months. Ticks in the first nymphal stage may live for slightly more than 9 months, those in the second nymphal stage for about 15 months, and those in the adult stage for nearly $2\frac{1}{2}$ years. In each of these cases the specimens observed were kept in tight boxes and no food was given. Other observers have recorded still greater longevity among adults of this species. Some of them state that the tick may live over 3 years without food. Dr. C. V. Riley has published a statement to the effect that they have been observed to live some 5 years without food. Our observation upon hundreds of individuals indicate that there must be some mistake about this record.

SUMMARY OF LIFE CYCLE.

The eggs of this tick hatch into larvæ in from 10 to 100 days. The seed ticks, or larvæ, attach to a fowl and feed from $3\frac{1}{2}$ to 10 days, after which they drop from the host, mainly at night, and secrete themselves in protected places. During warm weather the skins of the seed ticks are molted in from 4 to 7 days and the eight-legged nymphs appear. The second engorgement, which always occurs at night, requires only a few hours at most, after which the ticks again secrete themselves and molt their skins. The third engorgement also occurs at night, as do all subsequent feedings. Following this engorgement the ticks require 11 or more days in which to shed their skins. About six-sevenths of the resulting ticks are now mature. These are ready for depositing eggs after another engorgement and mating. The other one-seventh of the individuals are still nymphs after the third molt and must of necessity feed once

more and molt their skins again before becoming adults. The last nymphal molt in this case has been found to require 9 or more days. The adults are ready for engorgement soon after the last molt, and deposition begins after mating has taken place. As many as seven engorgements and depositions have been observed, an average of 537 eggs being deposited by each female tick.

The number of generations of the chicken tick annually has not been determined. It is possible for the tick to develop through all of its stages and thus complete its life cycle in about 40 days. Normally, however, it probably takes at least two months, in warm weather, for this complete transformation. Although breeding continues through the winter it is greatly retarded during the coolest weather. It is estimated that about five generations occur annually in the southern part of the range of the tick.

NATURAL AGENCIES OF CONTROL.

As has been pointed out, this tick does not thrive in portions of the Southern States which have a humid climate. This fact, together with experimental evidence, indicates that the species is largely controlled by excessive moisture. It has also been found that the injury inflicted by the species is greatest during hot, dry seasons. It also appears that low temperatures are important in reducing the rapidity of multiplication and other activities, and that where very cold winters occur the tick does not exist.

The species is singularly free from natural enemies. The little black ant (*Monomorium minutum*) has been seen carrying off the eggs and larvæ, and some of the house-inhabiting spiders probably destroy limited numbers of the tick in the later stages. Rats and mice are also concerned in its destruction in these stages. Chickens eat the tick with avidity when they have access to it. However, it is greatly protected by its habits of night feeding and of crawling deeply into cracks during the day. These habits also make it practically exempt from destruction by insectivorous birds.

CONTROL MEASURES.

METHODS OF PREVENTING INFESTATION.

It is much easier to exclude the fowl tick from premises which are not already infested than to eradicate it after an infestation has become established. Hence it is advisable, when poultry raising is being started, to choose a site some distance from where chickens have roosted. If it is possible to have the entire poultry farm well separated from other farms the exclusion of the tick is made more certain. No chickens, or coops which have contained chickens, should be brought near the site of the new yards. This demands

the use of the incubator for starting and replenishing the flock. When the chicken yards are built in proximity to infested premises extreme care should be exercised by the poultryman to exclude his fowls from these premises, as well as to prevent foreign poultry from entering the tick-free yards. Frequent and careful inspections should also be made of chicken houses to be certain that an infestation has not occurred from unguarded sources. If it is desired to bring stock in, this should be kept quarantined at some distance from the chicken yards for 10 days. The temporary coops in which the poultry is kept during this period should then be burned or dipped in boiling water to insure the destruction of all ticks. As has been stated under the discussion of the life history of this species, the seed ticks may remain attached to the host for a period of 10 days, hence the recommendation that fowls be quarantined for that period. At the expiration of the 10 days all of the ticks will have dropped and hidden themselves in the cracks of the coop. They may then be destroyed by the methods mentioned. When poultry is to be moved from an old chicken house into a new one the same method of freeing them from ticks should be employed.

METHODS OF COMBATING INFESTATION.

It is of much importance to determine as early as possible whether or not the fowl tick is present in the chicken house. Oftentimes the small blue seed ticks are observed upon the skin of poultry which is dressed for consumption. The presence of these little parasites should always cause the owner to turn his attention to the chicken coops. Whenever the combs and gills of chickens appear pale or signs of weakness are exhibited the cause can often be ascertained by making an examination of the roosting places. Frequently severe losses are sustained without the presence of the pest becoming known to the poultryman. It is therefore necessary to make frequent careful examinations of the cracks in the vicinity of the roosts to determine if an infestation exists. When ticks are found it is important to determine how extensive is the infestation and where the majority of the ticks are. If many specimens are found in all parts of the building and if the structure is of little value, the easiest and surest way of destroying the pest is to burn the entire chicken house. If, however, the ticks are not to be found in all parts of the building and if it is of too much value to be destroyed, other methods of fighting the tick should be adopted. In the first place all unnecessary boards and boxes which form protection for the tick should be removed. The house should then be thoroughly sprayed with pure kerosene, crude petroleum (Beaumont oil), creosote, or some of the standard tick dips used at a strength of 1 part of the dip to 3 parts of water. A thorough spraying with whitewash containing carbolic acid has

also been recommended. Many other destructive agents have been employed with greater or less success; among these are boiling water, creosoted products, and strong kerosene emulsion. The application of hot tar to the interior of infested houses has given some relief from the pest in certain instances. The tar tends to fill up the cracks and to seal up the ticks already in them.

When chickens are found to be suffering from the attack of the tick they should be removed immediately from the house in which the ticks occur. It is possible to destroy many of the larvæ which are attached to the bird, but as a rule it is sufficient to shut the affected chicken up and allow the larvæ to become engorged and drop off. In case chickens become very weak from attack before the trouble is located it is advisable to apply kerosene and lard to the underside of the wings and breasts in order to destroy some of the larvæ already attached. Practically all of the seed ticks on the chickens may be destroyed by submerging them in one of the creosote dips, mixed with water in the proportion of 1 to 10. Plunging infested fowls into gasoline has been found to destroy every tick attached to them, but this treatment is too harsh on the host to be recommended. In general, dipping of the birds is inadvisable, as that treatment is rather severe, and usually if the chickens are kept from further infestations they soon recover from the attack.

The chicken tick has been found to be one of the most difficult forms of animal life to destroy. It is able to survive applications which would kill practically any form of insect life. Insect powder, kerosene emulsions, and creosote dips used at the ordinary strength and fumigation with such poisonous substances as hydrocyanic-acid gas are entirely inadequate to destroy the pest. On account of the ability of the ticks to crawl far into very narrow cracks it is practically impossible to strike all of them with any substance applied. This necessitates the repetition of the treatment at intervals of a week or 10 days, until the tick is brought well under control.

Numerous devices have been used or advocated for protecting chickens from tick attack. Among the contrivances for isolating the roosts may be mentioned wrapping the ends of the poles in waste or cotton soaked in petroleum and supporting the roosts by means of rods running through cups filled with kerosene or other deterrent material. If these methods are employed for protecting the poultry care should be taken to keep the repellent substances fresh and not to allow the dust to accumulate on the top. In any event the roosts should be smooth and free from bark and cracks so as not to furnish hiding places for the ticks. They should also be arranged so as to be easily removed to permit of cleaning the house and applying petroleum or creosote around the ends of the roosts and other places where the ticks are most apt to hide. Gasoline torches have been used in de-

stroying ticks with some success. This method is very effective in eradicating the pest from noninflammable buildings such as are discussed under "tick-proof houses." *A very simple and inexpensive method of protecting fowls from the tick is to suspend the roosts by means of small wires from the ceiling. Wires should also be run from the roost to the side of the building in order to prevent the framework from touching at any point.* This arrangement in various forms is being used by a few chicken raisers in many localities, and in most cases with marked success. The method is inexpensive, can be adapted to any kind of chicken house, and requires only sufficient attention to make certain that the roosts and roost frames themselves do not become infested.

As has been stated, the longevity of this species is so great that this method alone can not be relied upon to kill out the ticks already in the building, as a few of them are certain to become engorged on setting or laying hens, or on chickens which remain on the ground, and thus keep the infestation alive. In view of these facts it is recommended that along with the suspension of the perches on wires, spraying or mopping with petroleum or creosote be practiced.

For the most part conditions throughout southwestern Texas and other parts of the infested territory are favorable for the breeding of this pest. Cedar posts which are covered with bark and filled with deep crevices are extensively used in and about the chicken houses. In some cases the chickens are compelled to roost in trees and about barns owing to the erroneous idea that by this method they will escape the chicken ticks which are usually concentrated in the chicken houses. This practice only serves to scatter the ticks about the premises and often induces infestations of the barns, trees, and fences. This makes it possible for the ticks to get on the chickens in any place about the yards and practically prevents successful control. Where poultry commonly roost in trees it is a good policy to remove all of the loose bark from the trees used as roosting places and to fill all holes and crotches in them with tar.

The whitewashing of buildings and general cleanliness maintained in order to keep the chicken tick in check are of much advantage in warding off some of the diseases to which poultry is subject. Many of the control methods advocated are of decided importance in combating other poultry pests. Applications of tickicides to chicken houses are sure to destroy the chicken mite (*Dermanyssus gallinæ* Redi), which has a habit, very similar to that of the chicken tick, of hiding in the cracks. These applications also aid in controlling the chicken flea (*Sarcopsylla gallinacea* Westw.), which is of considerable importance in certain sections of this country.

TICK PROOF HOUSES.

When it is planned to construct new quarters for poultry the matter of protection from this pest should be kept in mind. It is possible to build chicken houses which are practically tick proof; moreover, the cost of building and maintaining such structures does not greatly exceed the outlay necessary to construct a house which would favor tick development.

Houses can be built of a variety of different materials so as to make it very easy to control this pest. If it seems desirable to build a frame structure all parts should be made of smooth lumber and care should be taken to furnish the least possible number of hiding places for the ticks. Shingle roofs when once infested are exceedingly difficult to rid of ticks. It is therefore advisable to make the roof of corrugated iron, tin, or one of the patent roofings.

The all-metal chicken house has many advantages over wooden or partially wooden structures. A number of such houses built mainly of metal are in use in southwestern Texas and have been found practically tick free, although no precautions were taken against introducing ticks with the poultry or of treating the inside of the houses.

In constructing a poultry house the individual needs largely govern the style and size of the structure. The cost of materials required for an all-metal house 14 feet long, 10 feet wide, and 7 feet high in front, with a roof sloping one way, has been found to amount to about \$25. These figures are based on the use of three-fourths inch piping for the framework and painted corrugated iron for the covering. The difference in price of painted and galvanized iron is considerable, the former being about \$2.40 per square and the latter about \$3.50. The painted iron will be found satisfactory for use at inland points. Its life may be increased by applying an occasional coat of paint. In the construction of the frame it is necessary to have the piping cut to the required lengths and threaded. The large number of short pieces of piping and the considerable number of crosses, elbows, and T's make the assembling of the frame rather difficult. Where angle iron is available it is more desirable and costs no more. The corrugated iron may then be riveted on or cleated on as would be done if the piping frame were used. Wooden frames may be employed if the metal is too expensive or difficult to obtain. When wooden frames are used it is best to put the framework on the outside of the sheeting. These corrugated iron houses are very hot during the day and therefore shade, other than that afforded by the houses, should be provided in the chicken yards. This extreme heat and the lack of protection are the essential factors in keeping the chicken tick out. The tick will never become a serious nuisance in an all-metal house if protection, such as loose boards, nests, etc., is not given it. Never-

theless it is advisable to avoid introducing the pest, if possible. The complete destruction of the tick, should it become established in a metal house, is easily accomplished by removing the roost and burning a considerable quantity of straw, paper, or other light material within the house. All parts of the house should be thoroughly heated or reached by the flame. As has been stated the roosts should always be arranged to permit of easy removal for cleaning and other purposes.

It is recommended that nests be located apart from roosting places. Tick-proof nests or boxes isolated by means of legs set in dishes filled with kerosene are desirable. If, however, the nests are made of ordinary boxes and not allowed to come in contact with any walls it is seldom that they will become infested to any degree if thoroughly cleaned out occasionally. Should these boxes become infested they can be destroyed with little loss. Metal nests may be made with a ring of small iron to which is attached a sort of basket made of wire netting. These nests may be thoroughly cleaned by burning the straw which they contain and holding the wire part over the blaze. In the infested territory brooders and pens should be selected or constructed with a view to lessening hiding places which may be occupied by this pest.

That the fowl tick can be kept completely out of a poultry farm has been demonstrated conclusively by a few progressive poultrymen in Texas, but this is the reward of scrupulous cleanliness and constant vigilance.

Approved:

JAMES WILSON,

Secretary of Agriculture.

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